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## Mobility, subsistence, and technological strategies of early Holocene hunter-gatherers in the Bolivian Altiplano

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### ABSTRACT

The Altiplano constitutes the most extensive, high-elevation terrain in South America. Most archaeological research on the earliest human occupation of this region in the Bolivian Andes derives from sites such as Viscachani where the emphasis has been on typological comparisons of projectile points, rather than on complete and radiometrically dated assemblages. In this paper, we present survey and excavation data from the Iroco region in the Central Altiplano of Bolivia to address questions related to the adaptive strategies engaged by Archaic Period highland foragers. Specifically, we focus on the nature of mobility, subsistence, and technological strategies, stemmed from principles in human behavioral ecology. Based on data from radiocarbon dates, lithic, and faunal analyses, we suggest that, similar to other mobile foraging societies in arid environments, highland foragers in Iroco engaged in seasonal residential mobility, consumed a broad range of faunal resources, and developed a curated technological toolkit within the context of ameliorated environmental conditions that prevailed during the early Holocene (11,500–8000 cal BP).

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### 1. Introduction

The Andean Altiplano covers over 200,000 km<sup>2</sup>, constituting the greatest extension of highland terrain (>2500 m above sea level [asl]) in South America. Situated between the extrusive western cordillera and the intrusive eastern cordillera of the South Central Andes, the Central Altiplano is a semi-arid plain intersected by Río Desaguadero, the only outflowing river from Lake Titicaca, which runs 398 km to the south, draining into Lake Poopó. This region is best known for the well-documented emergence of complex agricultural and pastoralist societies during the late Holocene (3500–1500 cal BP) (Hastorf, 2008; Quilter, 2014; Stanish, 2003). Understanding the trajectories that led to these developments requires a more thorough examination of the social and economic strategies of the earliest hunter-gatherers to settle the Altiplano

(Aldenderfer, 2009; Aldenderfer and Flores Blanco, 2011; Capriles and Albarracín-Jordan, 2013; Osorio et al., 2017a).

Most research regarding the Archaic Period of the South Central Andes (10,000–3500 cal BP) has been carried out in southern Peru, northern Chile, and northwest Argentina (Aldenderfer, 1989, 1998, 2008; De Souza, 2004; Dillehay, 2000, 2008; Grosjean et al., 2005; Haas and Viviano Llave, 2015; Haas et al., 2017; Méndez, 2013; Núñez et al., 2002; Osorio et al., 2011, 2017b; Pintar and Rodríguez, 2015; Pintar et al., 2016; Politis et al., 2008; Rademaker et al., 2013, 2014; Santoro and Núñez, 1987; Santoro et al., 2011; Yacobaccio et al., 2017). In the case of the Bolivian Central Altiplano, a number of aceramic sites have been reported and classified as “preceramic” and assumed to be considerably old, despite the fact that very few of them have been systematically dated or excavated (Capriles and Albarracín-Jordan, 2013; Lanata and Borrero, 1999; Paz et al., 2014). Open-air occurrences like those at the well-known site of Viscachani have yielded thousands of stone tools, but research has so far been focused mainly on typological assessments (Ibarra Grasso, 1965b). Analyses of bifaces

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and projectile points were used to propose a hypothetically early human occupation for the site (Patterson and Heizer, 1965; Lizarraga-Mehring, 2004). A lack of both radiometric dating and correlation to environmental conditions have been major impediments to interpreting sites like Viscachani and using their rich collections to reconstruct early hunter-gatherer strategies in the region. Just as problematic, however, is the current lack of coherent theoretical approaches for organizing comparative studies of hunter-gatherers in the Altiplano region.

In this paper, we attempt to address these issues by contributing new chronological data for early Holocene (11,500–8000 cal BP) hunter-gatherers on the Altiplano, and applying a framework of human behavioral ecology (HBE) to the subsistence and technological signatures of the focal sites. We will focus on the locality of Iroco, located 125 km southeast of Viscachani and within the same high-elevation arid environment. We use HBE as a reference framework to address four questions: (1) How residentially mobile were these hunter-gatherer populations? (2) What was their subsistence base? (3) How did they organize technological strategies? (4) What role did climate change have in shaping human resource-use strategies in the region? By addressing these questions, we also aim at furthering our understanding of the evolutionary processes that eventually led to the development of agriculture, pastoralism, and the emergence of social complexity in the South Central Andes.

We rely on HBE principles to develop an argument that Archaic Period foragers engaged in solving important livelihood trade-offs, and, as such, we expect material patterns to reflect effective solutions to challenging social, demographic, and ecological conditions (Bird and O'Connell, 2006; Winterhalder and Smith, 2000). In this paper, we lay out the framework for developing specific hypotheses about variability in subsistence, mobility, and technological organization, along with the sorts of data we will need to collect to test them. Our working hypothesis is that subsistence behavior of the Archaic Period Central Altiplano hunter-gatherers was constrained and opportunized by a series of environmental factors such as high-elevation, aridity, low primary productivity, highly seasonal and variable precipitation, and predictable availability of key resources including fresh water, stone raw materials, and faunal resources.

## 2. Viscachani and the Archaic Period of the Central Altiplano

Archaeological research on the Archaic Period (ca. 11,500–3500 cal BP) of the Bolivian Central Altiplano has been limited to a handful of sites, typological comparisons based on undated assemblages, and a complete absence of subsistence related studies (see Capriles and Albarracín-Jordan, 2013; Lanata and Borrero, 1999). A case in point is Viscachani, an open-air site located between La Paz and Oruro, at an altitude of 3820 m above sea level (asl), in the vicinity of a well-known hot spring. Extending between six and eleven hectares, Viscachani is covered with lithic projectile points, flakes, and other stone tools (Ibarra Grasso, 1955; Ibarra Grasso, 1957; Ibarra Grasso, 1965a; Ibarra Grasso, 1965b; Lizarraga-Mehring, 2004). Ibarra Grasso suggested that the settlement was located on top of 8–15 m tall terraces, on the shores of a now dried-up ancient glacial lake. Surface collections carried out between 1954 and 1960 produced over 9000 artifacts (see also Vela, 1964). Excavations included five initial test pits (Ibarra Grasso, 1957:145; Ibarra Grasso, 1965b:32) and 30 additional shovel probes conducted in 1960 in collaboration with German scholars Hermann Trimborn, Hansjürgen Müller-Beck, and Josephine Welt (Ibarra Grasso, 1965a:13; Trimborn, 1967). Nevertheless, no substantive stratigraphy of these pits was documented, due to a combination of aeolian soil deflation and agricultural plowing affecting the site.

Ibarra Grasso (1955) initially classified the Viscachani projectile points in two types; the first included elongated points similar to

willow leaves and with fine lateral retouching, whereas the second type consisted of broader points, similar to bay leaves, which were worked by a percussion flaking technique. The first type was linked to the Ayampitín complex described by Alberto Rex González (1952) from a cave and additional open-air sites located in the Argentinean province of Córdoba; comparable to the “leaf-shaped projectile point complexes” (Willey, 1971:53). The second tool kit was compared to a “Paleolithic” bifacial lithic tradition (Lynch, 1983; Willey, 1971). Oswald Menghin (1954) subsequently named these groups, from younger to older industries “Ayampitínense” and “Viscachaniense”, respectively. Ibarra Grasso (1965b:54–57) then subdivided these groups into five chronological phases and speculated that the Viscachani site could be several thousand years old.

Andean archaeologists welcomed this new addition to the list of Andean early sites (e.g., Kornfield, 1977; Lanning, 1967; Lanning and Hammel, 1961; Lynch, 1983; Núñez, 1980; Ravines, 1972; Willey, 1971), albeit with some criticism. For instance, Edward Lanning and Eugene Hammel (1961) argued that the distinction between the two industries was probably artificial. Thomas Patterson and Robert Heizer (1965) carried out a technological and stylistic analysis of 63 artifacts, mostly composed of projectile points, suggesting that the bulk of the assemblage was similar to the earliest (Ayampitín) level of Intihuasi Cave (ca. 8250 BP) in central Argentina, and the Luz (ca. 7450 BP) and Canario (ca. 6900 BP) complexes in the Peruvian coast. In 1997, Karen Lizarraga-Mehring carried out additional fieldwork in Viscachani, including the excavation of a 1 m<sup>2</sup> unit in the center of the dispersion of stone tools, very close to Trimborn and colleagues' pits. As a result, she documented a hearth in association with 466 lithic artifacts, including 19 projectile points and as many as 172 camelid bones. Unfortunately, a bone sample selected for radiocarbon analysis did not contain enough collagen to produce a date (Lizarraga-Mehring, 2004). Despite the absence of systematic regional research and radiometric dating, Viscachani is still cited as an emblematic example of a highland foraging locale (e.g., Aldenderfer, 2009; Bruhns, 1994:60; Dillehay, 2000:181).

The discovery of Viscachani prompted systematic archaeological research that resulted in the discovery of several highland sites in the Andes. Many of these sites are rock shelters located in the highlands of the Peruvian central Andes and northern Chile, which provide different insights into the process of human adaptation to this environment (see Aldenderfer, 1989; Lynch, 1983; Núñez, 1980; Rick, 1980; Ravines, 1972; Santoro, 1989; Santoro and Núñez, 1987). In addition, a few open-air sites, such as Asana, a multicomponent residential base located in southern Peru, revealed previously unknown aspects about highland foraging and its change through time (Aldenderfer, 1989, 1998). The systematic survey of a series of western river tributaries of Lake Titicaca, specifically designed to identify Archaic Period occupations, has yielded significant results (Cipolla, 2005; Craig et al., 2010; Klink, 2005). Dozens of occupations associated with diagnostic projectile points evidence important site variability and settlement pattern changes throughout the Holocene (Haas et al., 2015). The systematic excavations of a few of these sites has also helped to frame discussions on the emergence of agriculture, metallurgy, and the manifestation of interpersonal violence (see Aldenderfer et al., 2008; Haas and Viviano Llave, 2015; Hastorf, 2008; Rumold and Aldenderfer, 2016; Tripcevich and Capriles, 2016).

Paleoenvironmental reconstructions based on the chronostratigraphic analysis of a series of sediment cores collected along the course of the Desaguadero River valley suggest that throughout the Holocene, the Central Altiplano experienced fluctuating climatic conditions within an arid climate regime (Rigsby et al., 2005). During the early Holocene (11,500–8000 cal BP), a few strong

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